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APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A
FILING DATE.**

APPLICATION NUMBER: 10/400,820

FILING DATE: March 27, 2003

RELATED PCT APPLICATION NUMBER: PCT/US04/09368

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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. 1.53(b))

Attorney Docket No. 3288-000011

First Inventor Fenelon

Title WINDOW LIFT MECHANISM

Express Mail Label No. EL 623481616 US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☒ Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Applicant claims small entity status.
See 37 CFR 1.27.
3. ☒ Specification [Total Pages 26]
(preferred arrangement set forth below)
 - Descriptive title of the invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to sequence listing, a table, or a computer program listing appendix
 - Background of the invention
 - Brief Summary of the invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure☒ Specification filed in English
4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 12]
5. ☒ Oath or Declaration [Total Pages 2]
 - a. ☒ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 CFR 1.63 (d))
(for a continuation/divisional with Box 18 completed)
 - i. ☐ DELETION OF INVENTOR(S)
Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. ☒ Application Data Sheet. See 37 CFR 1.76

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ACCOMPANYING APPLICATIONS PARTS

9. ☐ Assignment Papers (cover sheet & document(s))
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WINDOW LIFT MECHANISM

FIELD OF THE INVENTION

[0001] The present invention relates generally to an apparatus for moving a window into an open or closed position. In particular, the present invention relates to a mechanism for use with an automobile window, wherein the mechanism utilizes an improved dual rack and pinion assembly and method of manufacturing.

BACKGROUND OF THE INVENTION

[0002] Modern automobiles typically include a window lift assembly for raising and lowering windows in the door of the vehicle. A common type of window lift assembly incorporates a "scissor mechanism" or a drum and cable mechanism. A scissor-type system utilizes a series of linkages in a scissor configuration such that as the bottom linkages move apart, the top linkages do as well, resulting in a scissor-like motion. The window is fastened to a bracket connected to a linkage. A motor and gearset drives the scissor mechanism in power operated window mechanisms.

[0003] The scissor-type and drum and cable mechanisms are typically mechanically inefficient, prohibiting the use of light-weight materials and requiring the use of relatively large motors to drive the system. The large motors necessarily require increased space and electrical power and also increase the weight of the system. With the limited space in a scissor-type or drum and cable system it is also

necessary, in order to provide the required torque transfer efficiency and acceptable up and down times (3-4 seconds), to have a small diameter pinion gear, typically 0.5 to 0.75 inches, and relatively large worm gear, typically 1.8 to 2.5 inches in diameter, with gear ratios of 9 to 16 and 80 to 90, respectively. This results in excessive worm gear speed in the range of 3000 to 4000 RPM which causes excessive worm gear tooth shock and armature noise. The combination of high torque, typically 80 to 125 inch-pounds at stall, and shock due to high worm speeds mandates that either expensive multiple gears and/or single worm gears with integral shock absorbers be utilized.

[0004] Further, the scissor-type mechanism does not take into account the manufacturing deviations in the door, specifically with the window frame and mounting points, and deviations in the manufacture of the scissor-type mechanism. Deviations in the door and scissor-type mechanism result in larger than necessary forces being applied to the window when it cycles up and down. The larger force on the window causes undesirable noise in the passenger cabin.

[0005] Accordingly, a need exists for a window lift mechanism with increased efficiency that would allow for a reduction in the motor size and hence the mass of the system, and a support structure for the window that permits the window to find the path of least resistance when it cycles up and down.

SUMMARY OF THE INVENTION

[0006] The present invention provides a window lift mechanism that utilizes a dual rack and pinion drive mechanism that includes a motorized input

from a worm shaft that drives a worm gear drivingly connected to one of the pinions of the dual rack and pinion system. A motor with the worm driveshaft and the pinions are supported by a base which traverses the dual rack structure when the dual pinions are driven. According to one aspect of the present invention, the window lift mechanism has two support structures each including a window bracket coupled to the window. The window brackets each include a channel for receiving the window therein. A pair of metal plates are disposed on opposite sides of the window bracket and include a clamping mechanism engaging each of the pair of metal plates for drawing the metal plates toward one another.

[0007] According to an alternative embodiment of the present invention, the window brackets are each provided with a wedge mechanism received in the channel for securing the closure member in the channel.

[0008] According to another aspect of the present invention, a method for assembling a window lift mechanism is provided including mounting a motor to a base, the motor including a worm drive shaft and worm gear meshingly engaged therewith. The method includes loading pinion gears into the base by placing the pinion gear onto a drive shaft connected to the worm gear and mounting the second pinion gear in the base. A dual rack assembly is then placed in alignment with the pinion gears and power is applied to the motor to drive the pinion gears to engage the pinion gears with the rack.

[0009] According to still another aspect of the present invention, the dual rack assembly is made as a modular unit including a base or frame structure which is adapted to be mounted to the door of the vehicle. The pair of rack

members each including a plurality of gear teeth extending along the rack members are formed either as a molded unitary piece with the base structure, or are snap fit or otherwise fastened to the base structure for defining the modular unit.

[0010] According to yet another aspect of the present invention, the dual rack and pinion assembly is provided with a smart motor capable of detecting unusual forces applied to the window while being closed and capable of either shutting off or reversing drive of the motor. The system is further provided with one or more resilient shock absorbers operably engaged between the worm gear and pinion gears in order to allow the drive motor to have more time to react to unusual forces applied to the window.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0012] Figure 1 is a schematic view of a window lift mechanism for an automobile door according to the principles of the present invention;

[0013] Figure 2 is a partially cut-away view of the window lift mechanism according to the principles of the present invention;

[0014] Figure 3 is a perspective view of a support structure including a window clamp mechanism on the window bracket for the window lift mechanism according to the principles of the present invention;

[0015] Figure 4 is an end view of the support structure of Figure 3 illustrating a cross-sectional view of the window clamp mechanism on the window bracket;

[0016] Figure 5 is a perspective view of an alternative support structure including a window clamp mechanism on the window bracket for the window lift mechanism according to the principles of the present invention;

[0017] Figure 6 is an end view of the support structure of Figure 5 illustrating a cross-sectional view of the window clamp mechanism on the window bracket;

[0018] Figure 7 is a plan view of the main bracket of the dual rack and pinion system according to the principles of the present invention;

[0019] Figure 8 is a front plan view of the main bracket having a motor assembly mounted thereto according to the principles of the present invention;

[0020] Figure 9 illustrates the main bracket being mounted to the dual rack system by drivingly rotating the pinion gears therewith;

[0021] Figure 10 is a front view of the dual rack and pinion system fully assembled according to the principles of the present invention;

[0022] Figure 11 is a perspective view of a modular dual rack and pinion system for mounting to a door of a vehicle;

[0023] Figure 12 is a detailed view of the modular dual rack and pinion system according to the principles of the present invention;

[0024] Figure 13 illustrates a snap-fit engagement between a dual rack system to the frame of the modular assembly;

[0025] Figure 14 shows the dual rack system being mounted to the frame of the modular dual rack and pinion system utilizing threaded fasteners;

[0026] Figure 15A is a schematic view of a dual rack and pinion system utilizing multiple resilient shock absorbers according to the principles of the present invention;

[0027] Figure 15B is a partial perspective view of a dual rack and pinion system utilizing multiple resilient shock absorbers according to Figure 15B;

[0028] Figure 16 is an exploded perspective view of a slave pinion gear as illustrated in Figure 15;

[0029] Figure 17 is a cross-sectional view of the slave pinion gear of Figure 16 in an assembled condition;

[0030] Figure 18 is a plan view of one of the gear segments of the slave pinion gear of Figure 16;

[0031] Figure 19 is a graph illustrating the delayed force obtained in a smart motor window lift system utilizing multiple shock absorber, according to the principles of the present invention; and

[0032] Figure 20 is a graph providing a comparison of force-time distance plots as a window traverses up for a convention window lift mechanism versus a dual rack and pinion system with built-in shock absorbers according to the principles of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0033] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0034] Referring generally to Figure 1, a vehicle door 10 is shown schematically including a window lift mechanism 12. A window 14 is supported by the window lift mechanism 12 and is located within the automobile door 10. The window lift mechanism 12 includes a support structure 16 and a drive system 18. The drive system 18 is supported by the support structure 16 and serves to drive the support structure 16 relative to a pair of racks 20, 22 which are securely mounted to the door 10.

[0035] The support structure 16 includes a main bracket 24. According to a first embodiment, a pair of guide brackets 26 (best shown in Figures 3 and 4) are mounted to the main bracket 24 by a fastener 28 and a nut 30. The guide brackets 26 include a body portion 32 including an elongated vertical slot 34 for receiving the fastener 28. A pair of opposing stop flanges 36 extend from opposite sides of the body portion 32. An elongated semi-cylindrical guide portion 38 is disposed on an upper neck portion 40 of the guide bracket 26. The support structure 16 further includes a pair of window brackets 42 which are slidably engaged with the guide brackets 26.

[0036] The window brackets 42 have a window channel 44 for receipt of the window 14 and a guide channel 46 having a semi-cylindrical inner surface for receiving the semi-cylindrical guide portion 38 of the guide bracket 26, as best

[0037] As shown in Figure 3, the window bracket 42 is mounted to the window by a pair of generally V-shaped metal plates 50A, 50B which are sandwiched on opposite sides of the window bracket 42. The window brackets

42 are provided with recessed channels 52 on opposing faces thereof for receiving the metal plates 50 therein. As best shown in Figure 4, a threaded fastener 54 extends through an aperture 56 in the first metal plate 50A and through apertures 58 and 60 provided in the window bracket 42. The fastener 54 is threadedly engaged with an internally threaded aperture 62 provided in a second metal plate 50B. By tightening the threaded fastener 54, metal plates 50A, 50B are drawn inward against the side surfaces of the window bracket 42 causing the inner surface of the channel 44 to tightly engage the window 14. The inner sidewalls 64 of the channel 44 are provided with protruding engagement faces 66 at an upper end thereof for engaging the window 14. The recessed surfaces 52 provided on opposite faces of the window bracket 42 provide limit stops for the V-shaped metal plates 50A, 50B which act as spring members for applying a clamping force to the window bracket 42.

[0038] With reference with Figures 5 and 6, an alternative window bracket 70 is provided including a window channel 72 for receipt of the window 14 and a guide channel 74 having a semi-cylindrical inner surface for receiving the semi-cylindrical guide portion 38 of the guide bracket 26, as best shown in Figure 5. The guide channel 74 has an opening end portion 76 having a diameter greater than a width of the upper neck portion 40 of the guide bracket 26 so as to allow angular movement of the window bracket 70 relative to the guide bracket 26, as illustrated in Figure 6. The channel 72 is provided with a pair of opposing faces 76, 78. The face 78 is angled slightly relative to the face 76. A window 14 is inserted into the channel 72 and is disposed against the face

[0039] During assembly, the window 14 is inserted in the channel 72 and the wedge member 80 is inserted next to the window 14 and sidewall 78 of the channel 72. The cross-bar 92 of toggle spring member 84 is then pulled downward from the position shown in Figure 5 to the position shown in Figure 6 until the cross-bar portion 92 of the toggle spring member 84 engages the laterally extending fingers 106 extending from the base of the window bracket 70. In this position, the toggle spring member 84 applies a spring force to the clamping wire 100 that in turn applies a clamping force to the wedge 80 which is biased tightly into the channel 72 for applying a force against window 14. Thus,

in this manner, the window bracket 70 is easily mounted to the window 14 for securing the window 14 to the main bracket 24.

[0040] Referring to Figure 2, the main bracket 24 interacts with the racks 20, 22. The first rack 20 includes a row of teeth 110 which faces a row of teeth 112 on the second rack 22. Teeth 110 and 112 are in engagement with drive system 18 for raising and lowering the window 14. As shown in Figure 1, guide members 114 are provided on the main bracket 24, adjacent to the first and second racks 20 and 22. Guide members 114 keep the first and second racks 20 and 22 in engagement with the drive system 18. Guide members 114 are generally plastic guide channels integrally formed with the main bracket 24.

[0041] With reference to Figures 1 and 2, a general description of the construction and operation of the dual rack and pinion window lift mechanism 12 will now be described. First, the main bracket 24, which is generally shown in Figures 1 and 2, is shown in a more preferred arrangement in Figures 7-10. In particular, as illustrated in Figure 7, on a first face 116 of the main bracket 24, a pair of recessed channels 118, 120 are provided as well as recessed portions 122, 124 adapted to receive pinion gears 126, 128 of the drive system, as best illustrated in Figures 1 and 9. A motor housing assembly 130 is shown mounted to a second surface 132 of the main bracket 24 in Figure 8. The motor housing assembly 130 includes a motor 134 connected to a housing 136. The motor 134 is provided with a drive shaft 138 (best illustrated in Figure 2) having a worm 140 in meshing engagement with a worm gear 142. The worm gear 142 is supported on an axle 144 supported by the housing 136. The axle 144 connected to the

worm gear 142 extends through an aperture 146 provided in the main bracket 24, as best illustrated in Figure 7. During assembly, the motor housing assembly 130 is mounted to the main bracket 24 and is secured in place by threaded fasteners 148 (one of which is shown). After the motor housing assembly 130 is mounted to the main bracket 24, a drive pinion gear 126 is inserted in the recess portion 124 of the main bracket 24 and engaged with the drive spindle 144 of the worm gear 142. In addition, a slave pinion gear 128 is inserted in the recess portion 122 of the main bracket 24 and is in meshing engagement with the drive pinion gear 126. At this time, the motor 134 is connected to an electrical power source and a dual rack system 150 is brought into alignment with the channels 118, 120 of the main bracket 24 and inserted part way until the dual rack system 152 engages the pinion gears 126, 128. At this time, the motor 134 is driven in order to engage the pinion gears 126, 128 with the dual rack system 150, as best illustrated in Figure 10. The motor is then driven to move the main bracket 24 and motor 134 to a predetermined position for convenient door installation. The dual rack system 150 includes a pair of elongated parallel racks 20, 22 each including a plurality of teeth extending therealong. A lattice-type cross brace structure 151 extends between, and is integrally molded as a unitary piece with, the pair of racks 20, 22. All of the components, except the motor, are made from high precision engineered thermoplastics.

[0042] As illustrated in Figures 11-14, the dual rack and pinion window lift mechanism 12 is preferably mounted to a frame 160 that allows the frame 160 and window lift mechanism 12 to be mounted into a vehicle door as a modular

unit 162, as best illustrated in Figure 11. As shown in Figure 12, the dual rack system 150 is preferably molded as an integral piece with the frame 160. The frame 160 is provided with mounting holes 164 which facilitate mounting the modular unit 152 to the vehicle door 10. The door 10 is provided with corresponding mounting holes 165 which are in alignment with mounting holes 164 on the frame 160. In addition, the frame 160 is provided with additional mounting holes 166, as illustrated in Figure 12, to allow mounting of additional components 168 (shown in phantom) and that can include air bags, speakers, or other door components.

[0043] As an alternative to molding the dual rack system 150 integrally with the frame 160, the dual rack system 150 can also be provided with snap-fit engagement for connection to the frame 160 by including snap insert members 168 as illustrated in the cross-section of Figure 13, or fasteners 170 such as threaded bolts, screws, or rivets can also be utilized for connecting the dual rack system 150 to the frame 160 as illustrated in Figure 14. The modular unit 162 facilitates easy installation of the window lift mechanism into the door of the vehicle. Once the modular unit 162 is installed in the door, the window 14 can be inserted in the channels provided in the window brackets 42/70, and the window brackets 42/70 are then clamped to the window 14, as described above.

[0044] A recent development in power window regulators are referred to as smart regulators, i.e., to have the capability of going up and down fast by touching the switch once. Due to automotive regulations, it is mandatory that on the way up, that from 4 inches to 0.1 inch from the top, the window must be

capable of stopping and reversing prior to generating a force in excess of 100 Newtons. To achieve this, manufacturers have utilized sophisticated electronics and memory chips so that the window knows where it is at all times based on past or previous experience. In this way, if the window senses an object in its path, it will know that it is abnormal and hence, reverse. Essentially, detection methods are put in place by using memory chips employed within a controller 174, as illustrated in Figure 2, so that deviation from a "learned reference" is known. These "learned references" are typically based on motor speed, motor current, or rate of change in speed (acceleration). Electronics used in combination with the memory chips utilize expensive componentry, such as a current shunt, multiple pull magnets, hall sensors, and commutator pulse detection sensors. The cost and performance of the smart units are dependent upon the time available for the motor to "detect and react" to where it was prior to generating forces greater than 100 Newtons. While various smart motor systems have been successfully adapted to arm and sector and cable units, a number of problems exist. Specifically, the design of these systems are such that varying degrees of slack are inherent, and this slack varies continuously and unpredictably over the life of those products. The mechanical inefficiency of those systems requires that larger motors than necessary, typically motors capable of achieving 90 inch pounds plus are utilized which leaves a greater amount of excess force to cause damage to objects that may obstruct the window in the event of malfunctioning of the smart system. Dual rack and pinion regulators are precision manufactured from injection molded engineered

thermoplastic, which means that the degree of slack inherent in the system is repeatable, controllable, and based on experience gained, is constant over time. In order to increase the response time available to the smart motor system prior to reaching the 100 Newton force limitation, the dual rack and pinion system of the present invention is provided with a worm gear 142, drive pinion gear 126, and slave pinion gear 128 which are modified to act as shock absorbers. The shock absorbers slow down the pinch process so that a simplified smart motor may have more time to "detect and react" to any interruption in window upward movement.

[0045] With reference to Figures 15-18, a dual rack and pinion system utilizing multiple shock absorbers will now be described. As illustrated in Figure 15A, a worm 140 is in driving engagement with a worm gear 142. The worm gear 142 is provided in driving engagement with a drive spindle 144 via resilient spring members 180 which can be in the form of elastomeric shock absorber 182 as illustrated in Figure 16. The drive spindle 144 is drivingly connected to the drive pinion gear 126 via a second resilient spring member 184. As described previously, the drive pinion gear 126 is in driving engagement with the rack 22 of the dual rack assembly 150. Furthermore, the drive pinion gear 126 engages a first gear portion 128A of the slave pinion gear 128. The slave pinion gear 128 includes a second pinion gear portion 128B which is connected to the first pinion gear portion 128A via a resilient spring member 186. The second pinion gear portion 128B of the slave pinion gear 128 engages the rack 20 of the dual rack assembly 150. Figure 15B illustrates a perspective view of the dual rack and

[0046] Figure 16 illustrates an exploded perspective view of the construction of the slave pinion gear 128, as shown in Figure 15A, 15B. In particular, the first gear portion 128A of the slave pinion gear 128 includes a plurality of axially extending fingers 190 which are received in radially outwardly extending recesses 192 of the resilient shock absorber 182. Furthermore, the second gear portion 128B of the slave pinion gear 128 includes a hollow body portion provided with radially inwardly extending fingers 194 which are received in radially inwardly extending recesses 196 of the elastomeric shock absorber 182. With this construction, the shock absorber 182 is capable of absorbing shock forces that are delivered between the first gear portion 128A and second gear portion 128B of the slave pinion gear 128.

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assigned U.S. Patent Nos. 5,307,705, 5,452,622, and 5,943,913 for providing shock absorbance in a gear system.

[0048] When a shock absorber system is utilized in combination with a smart motor system and the upward moving window is obstructed and generates an impulse determined by force multiplied by time (Fxt) the shock absorbers increase the time factor, hence reducing the applied force at any point in time. With reference to Figure 19, the influence of shock absorbent on the force versus distance/time plot as a window traverses up, is illustrated graphically for a dual rack and pinion system utilizing different numbers of shock absorbers (0-3). As illustrated in the drawings, the use of each additional shock absorber increases the time that is available prior to reaching a stall force for the motor. This increase in time, due to the use of multiple shock absorbers, increases the ability of a smart motor to prevent the window from reaching a predetermined maximum force level. Accordingly, the componentry of the smart motor can be reduced in complexity and cost due to the additional time allotted for reaction to the detected force. An additional benefit of the use of multiple shock absorbers is that they reduce the amount of vibration transferred from components of the gear train to the next and, therefore, reduce the noise generated by the dual rack and pinion system.

[0049] Figure 20 graphically illustrates a typical arm and sector and/or cable system as compared to the dual rack and pinion system with built-in shock absorbers. It is noteworthy that existing arm and sector and cable units also have shock absorbers built into the worm gear of the system. As illustrated in

Figure 20, typical arm and sector and/or cable systems require higher amounts of force which are required to overcome gravity and guide friction as illustrated by point A on the line representing the conventional system. In comparison, for the dual rack and pinion system with built-in shock absorbers, the amount of force required to overcome the window weight and guide channel resistance is significantly less as illustrated by point B. In addition, because of the increased efficiency of the dual rack and pinion system, the system can be provided with a smaller motor which reduces the amount of torque applied by the system and therefore, reduces the amount of potential torque that can be applied to an obstruction in the window. A typical dual rack and pinion system utilizes a motor which uses approximately 65 inch pounds of torque as compared to an arm and sector or cable system which utilizes a motor capable of producing upward of 90 inch pounds of torque. Finally, the amount of time from hitting an obstruction until a stall torque is obtained for a conventional system is approximately 60 milliseconds, whereas for the dual rack and pinion system this time is approximately 140 to 200 milliseconds when utilizing built-in shock absorbers. The more time provided for detection of an obstruction, allows the use of a less complex and hence, more economic smart regulator system.

[0050] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A closure assembly comprising:
 - a closure member;
 - a window bracket coupled to said closure member, said window bracket including a channel for receiving said closure member therein; and
 - a pair of metal plates disposed on opposite sides of said window bracket and including a clamping mechanism engaging each of said pair of metal plates for drawing said metal plates toward one another.
2. The closure assembly of claim 1, wherein said pair of metal plates are generally concave and apply a clamping force to said window support member on opposite sides of said channel.
3. The closure assembly of claim 1, further comprising a support member coupled to said window bracket and adapted to be driven for the raising and lowering of said closure member; and
 - an interface between said window bracket and said support member permitting axial and pivotal movement of said closure member with respect to said support member.

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14. The closure assembly of claim 13, wherein said interface includes a head portion slidably and rotatably received in a guide portion.

15. The closure assembly of claim 14, wherein said head portion is semi-cylindrical and said guide portion is semi-cylindrical.

16. A method for assembling a window lift mechanism, comprising the steps of:

mounting a motor housing assembly to a main bracket, said motor housing assembly including a motor drivingly connected to a worm and worm gear, said worm gear including a shaft rotatably connected to said worm gear and extending through said main bracket;

mounting a first pinion gear onto said shaft and mounting a second pinion gear in meshing engagement with said first pinion gear;

placing a dual rack system in alignment with said pinion gears; and

applying power to the motor to drive said pinion gears to engage said pinion gears with said dual rack system.

17. The method of claim 16, wherein said step of applying power to the motor further includes driving the first and second pinion gears to move the main bracket and motor to a predetermined position for convenient door installation.

18. The method of claim 16, wherein said step of placing a dual rack system in alignment with said pinion gears includes placing the dual rack assembly in a guide system of said main bracket.

19. A dual rack assembly, comprising:

a base frame structure adapted to be mounted to a vehicle door;

and

a pair of rack members each including a plurality of gear teeth extending along said rack members, said rack members being snap fit to said base frame structure.

20. An integrally formed dual rack system, comprising:

a pair of elongated parallel racks each including a plurality of gear teeth extending therealong; and

a cross brace structure extending between said pair of elongated parallel racks and integrally molded as a unitary piece with said pair of elongated racks.

21. A window lift mechanism comprising:
- a dual rack system;
 - a support structure supported on said dual rack system;
 - a drive pinion gear supported by said support structure and in engagement with a rack of said dual rack system;
 - a slave pinion gear supported by said support structure, said slave pinion gear including a first gear segment in engagement with said drive pinion gear and a second gear segment in engagement with a second rack of said dual rack system, said first and second gear segments including a resilient shock absorber operatively engaged therebetween;
 - a worm gear supported for rotation by said support structure and operatively joined with said drive pinion gear; and
 - a motor supported by said support structure and including an output shaft having a worm engaged with said worm gear.

22. The window lift mechanism according to claim 21, further comprising at least one resilient shock absorber operatively engaged between said drive pinion gear and said worm gear.

23. The window life mechanism according to claim 21, further comprising a pair of resilient shock absorbers operatively engaged between said drive pinion gear and said worm gear.

24. The window lift mechanism according to claim 21, wherein said motor is a smart motor system capable of detecting obstructions and reversing operation thereof in response to a detected obstruction.

25. A window lift mechanism comprising:

a dual rack system;

a support structure supported on said dual rack system;

a gear train including:

a drive pinion gear supported by said support structure and in engagement with a rack of said dual rack system;

a slave pinion gear supported by said support structure in engagement with said drive pinion gear and a second rack of said dual rack system;

a worm gear supported for rotation by said support structure and operatively joined with said drive pinion gear, said gear train including a plurality of resilient shock absorbers disposed therein; and

a motor supported by said support structure and including an output shaft having a worm engaged with said worm gear.

ABSTRACT OF THE DISCLOSURE

A dual rack and pinion system is provided for a window lift mechanism. The window lift mechanism includes improved window brackets for simple mounting to a window. A modular frame design is provided to improve assembly of the window lift mechanism into the door of a vehicle. An improved assembly method is provided for the dual rack and pinion system. The system is also provided with a smart motor and incorporates resilient shock absorbers in the dual rack and pinion gear train to allow more time for the smart motor to detect and react to an obstruction in the window.

DECLARATION AND POWER OF ATTORNEY

Atty. Ref. 3288-000011

DECLARATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name,

I believe that I am the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled:

WINDOW LIFT MECHANISM

the specification of which (check one)

- ☒ is attached hereto.
or
☐ was filed on _____ as Application Serial No. or PCT International Application No. _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.


I hereby claim foreign priority benefits under 35 U.S.C. §§ 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)				
APPN. SERIAL NO.	COUNTRY	DATE FILED (MM/DD/YYYY)	PRIORITY CLAIM	
			Yes	No
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			<input type="checkbox"/>	<input type="checkbox"/>
			<input type="checkbox"/>	<input type="checkbox"/>


DECLARATION AND POWER OF ATTORNEY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY

I hereby appoint each practitioner at Customer No. 27572 () of Harness, Dickey & Pierce, P.L.C., my attorney with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

CORRESPONDENCE ADDRESS

I request the Patent and Trademark Office to direct all correspondence and telephone calls relative to this application to Customer No. 27572 (), Harness, Dickey & Pierce, P.L.C., P. O. Box 828, Bloomfield Hills, Michigan 48303 (248) 641-1600.

Full name of sole or first inventor: PAUL J. FENELON

Inventor's signature: 

Date: Mar 27th 03

Residence: 13 Inverary, Nashville, Tennessee 37215

Citizenship: US

Mailing Address: 13 Inverary, Nashville, Tennessee 37215

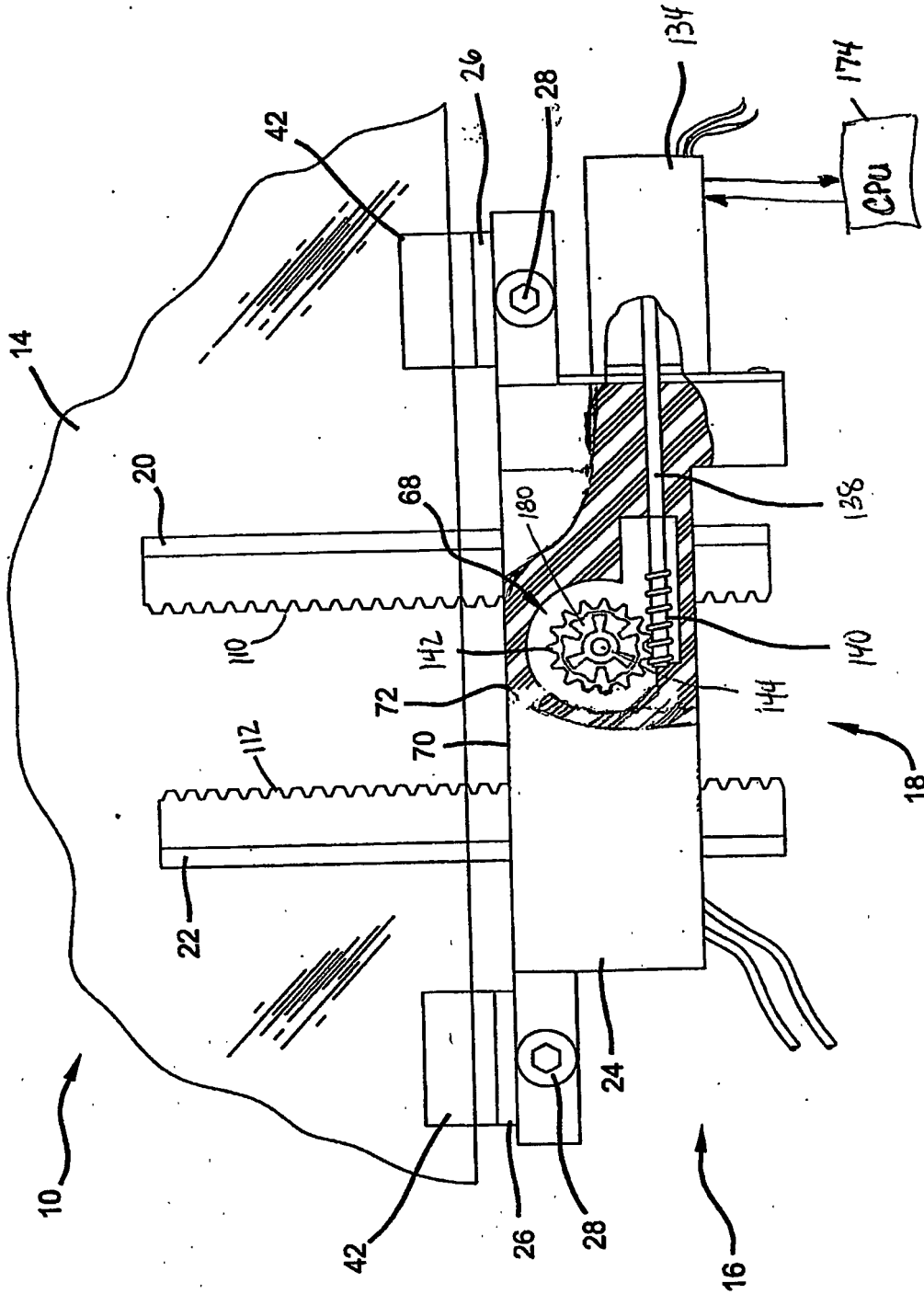


Figure 2

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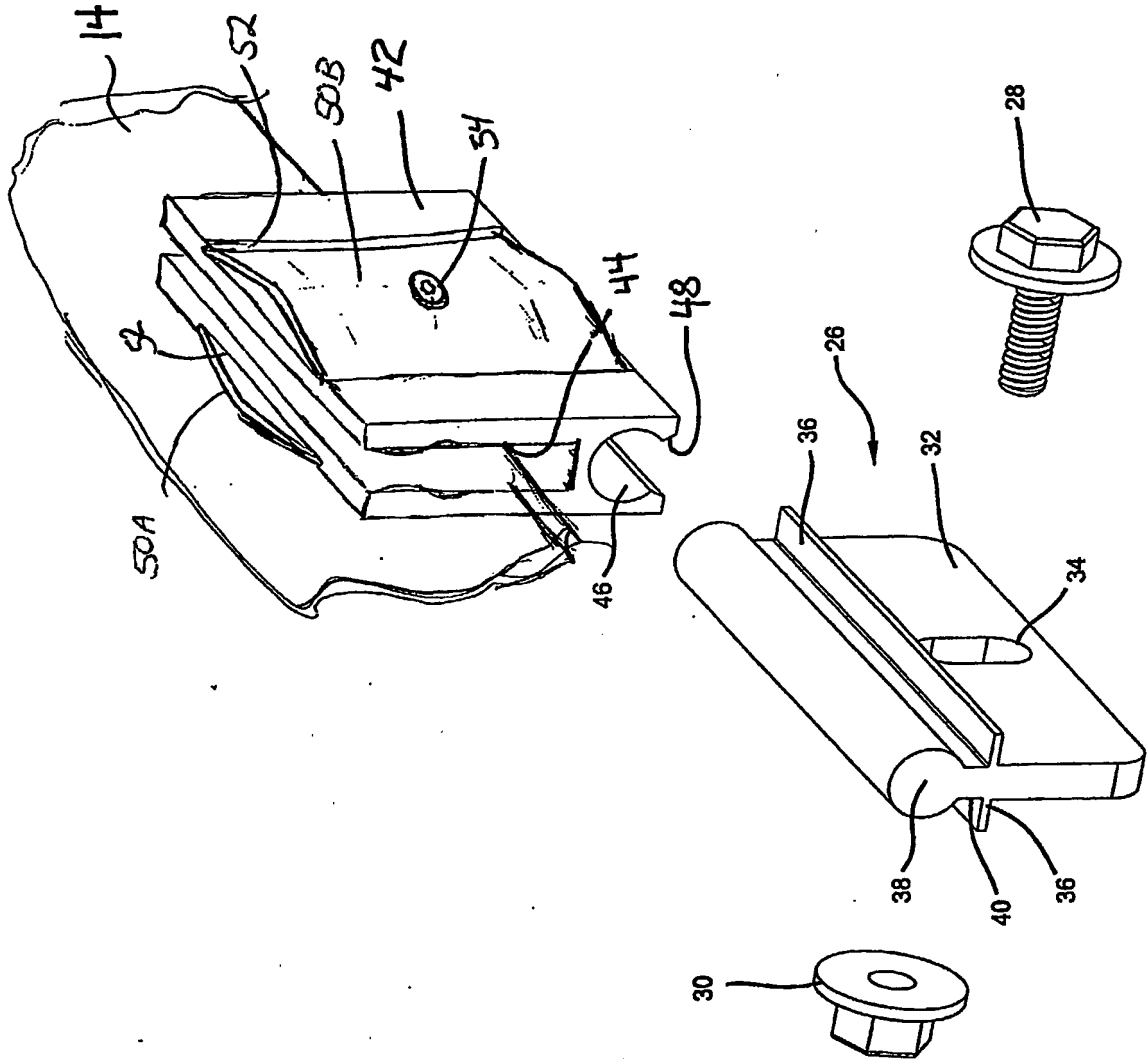


Figure 3

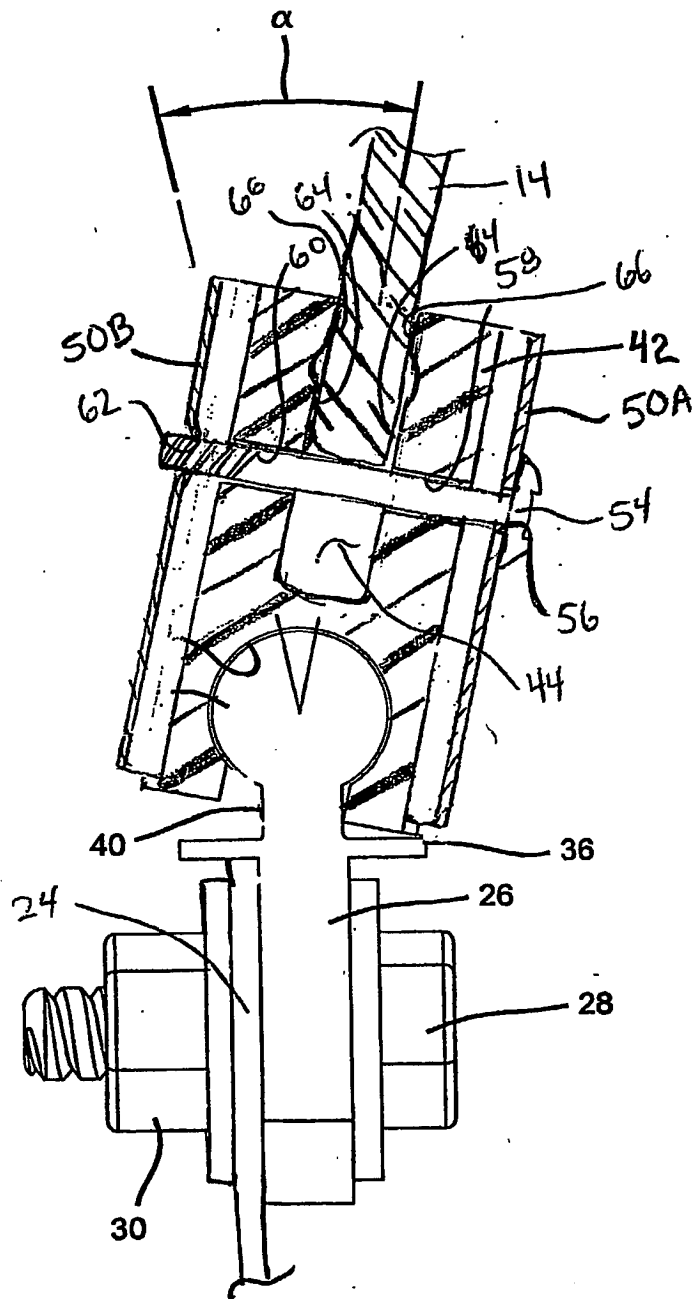


Figure 4

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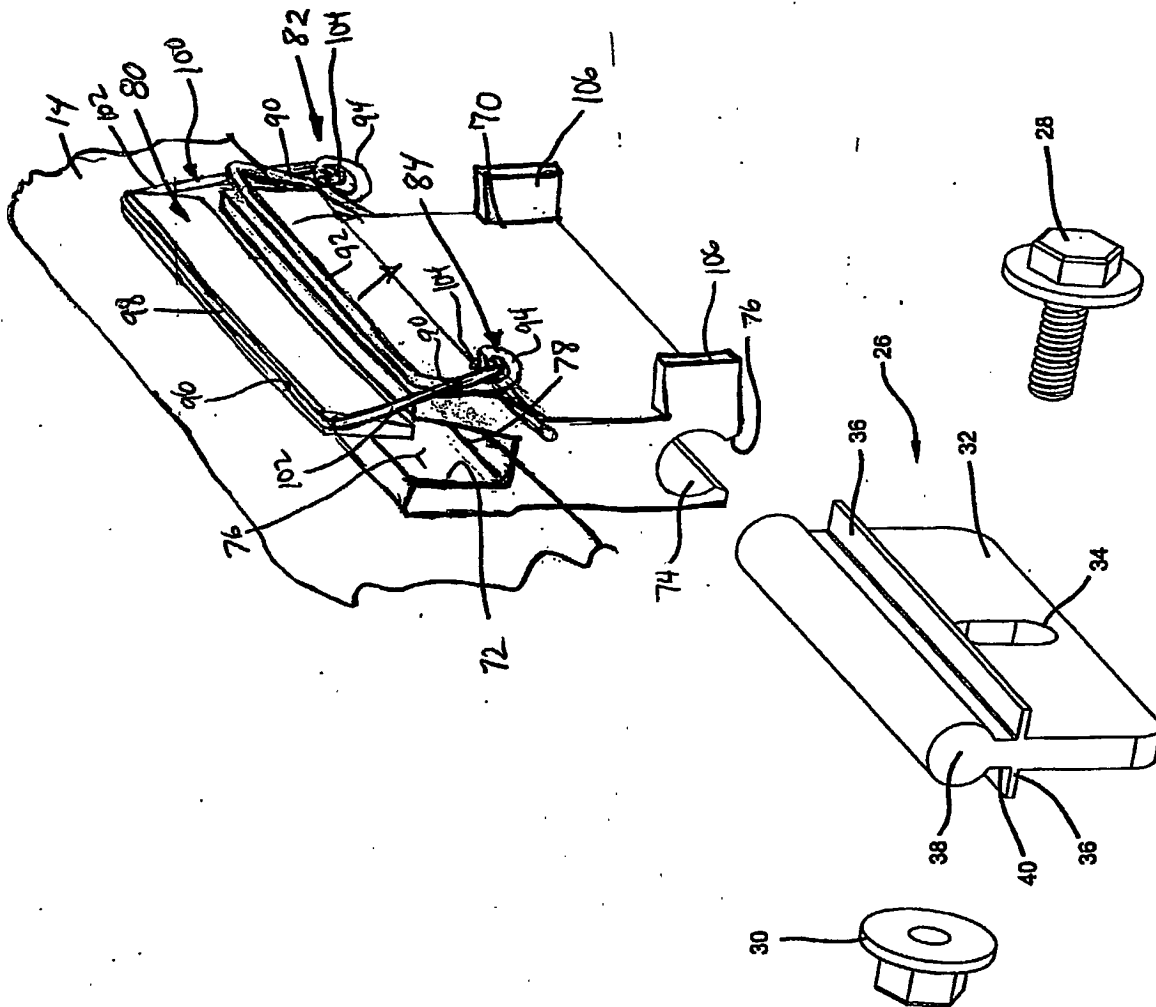


Figure 5

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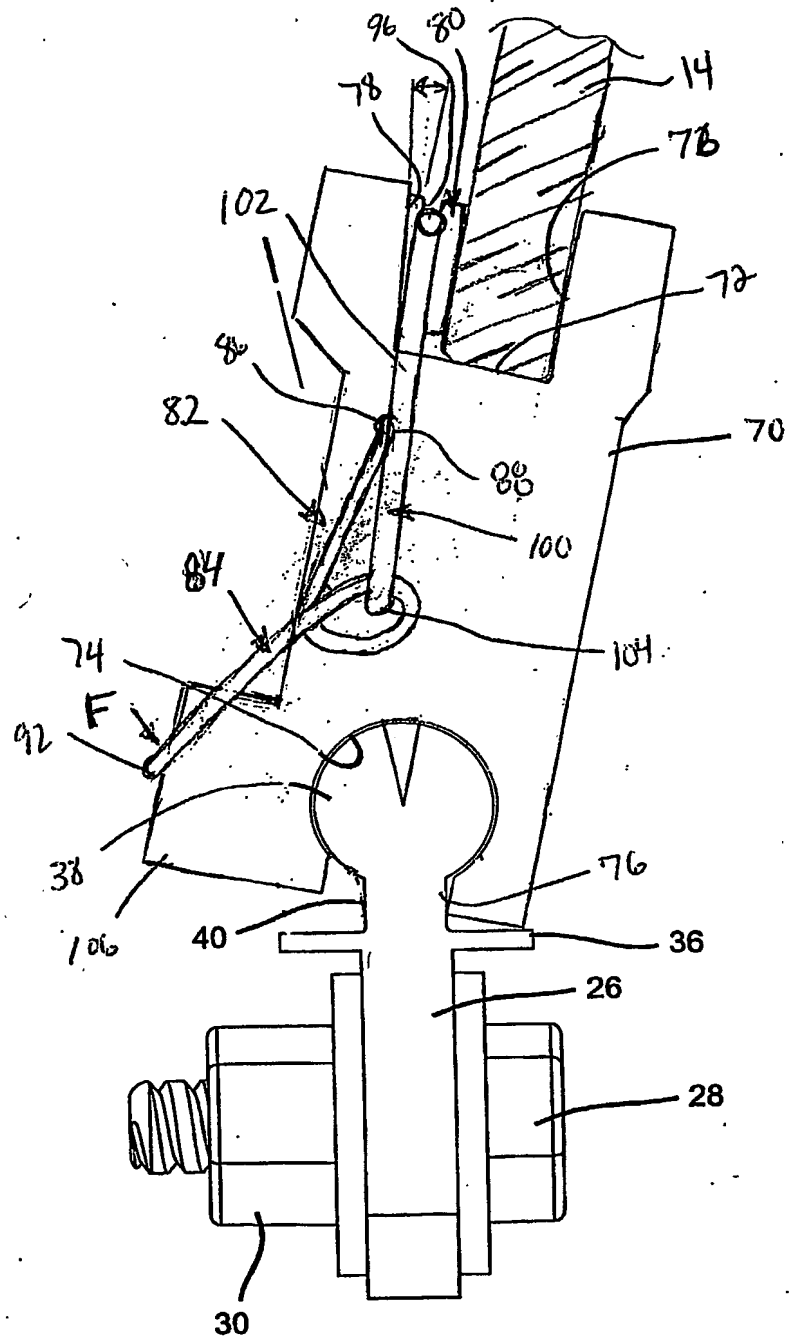


Figure 6

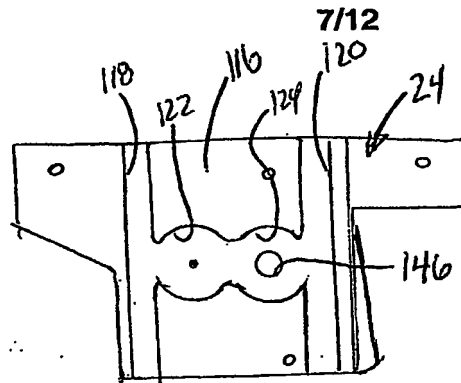


FIG. 7

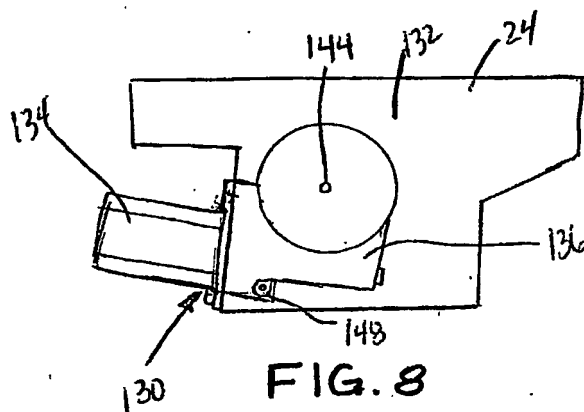


FIG. 8

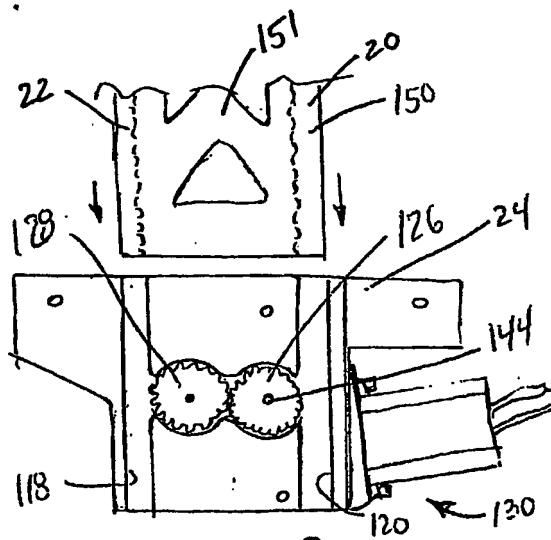


FIG. 9

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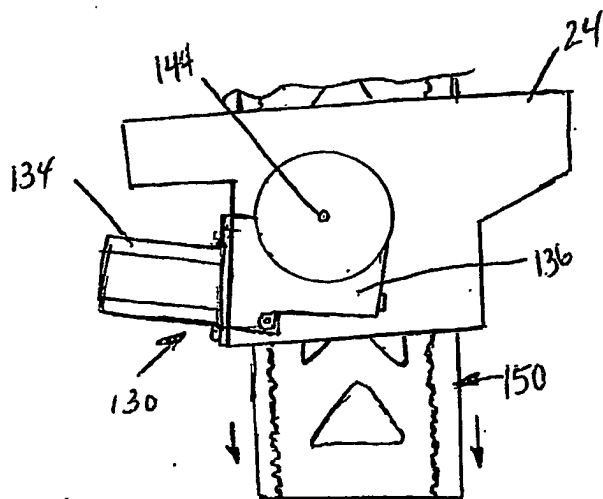


FIG. 10

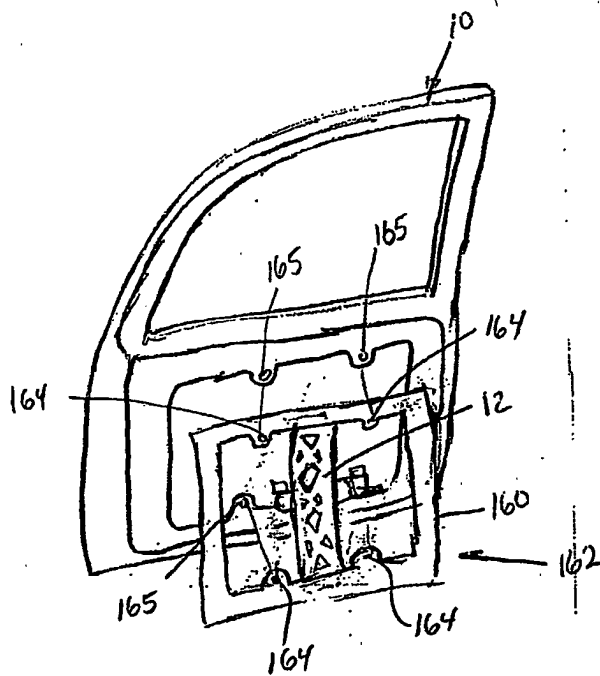
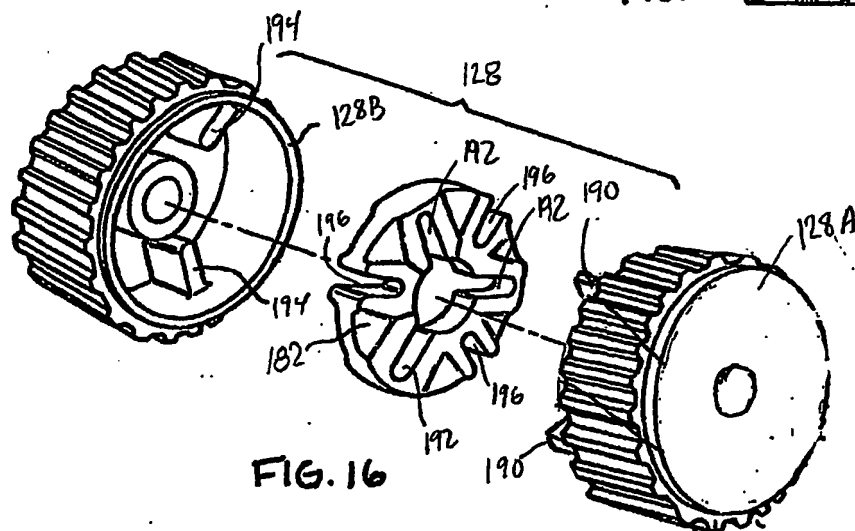
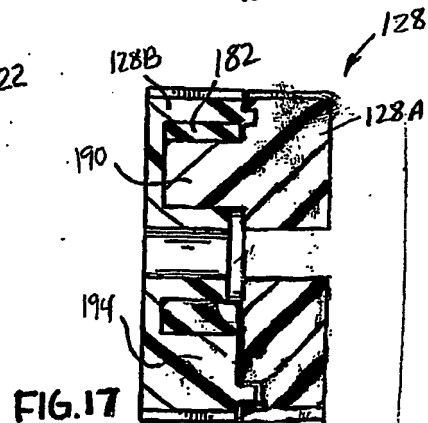
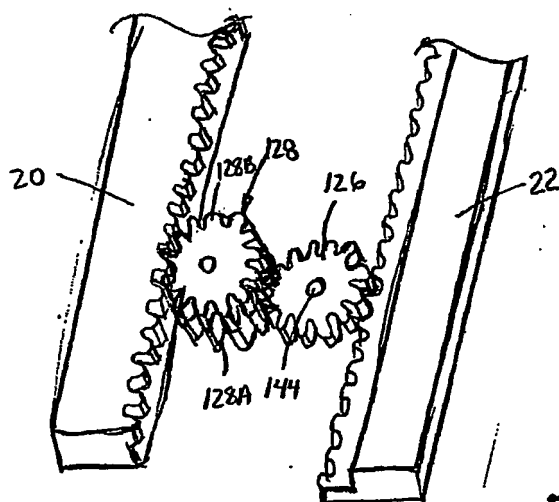
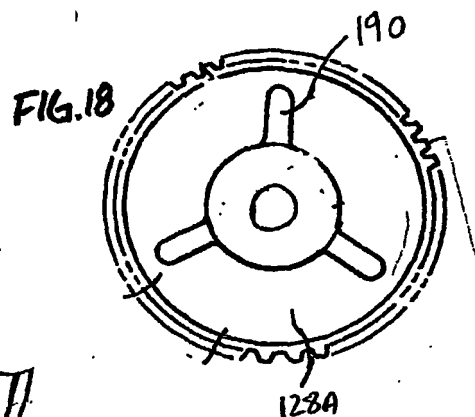
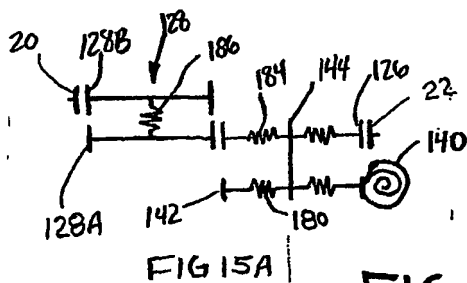


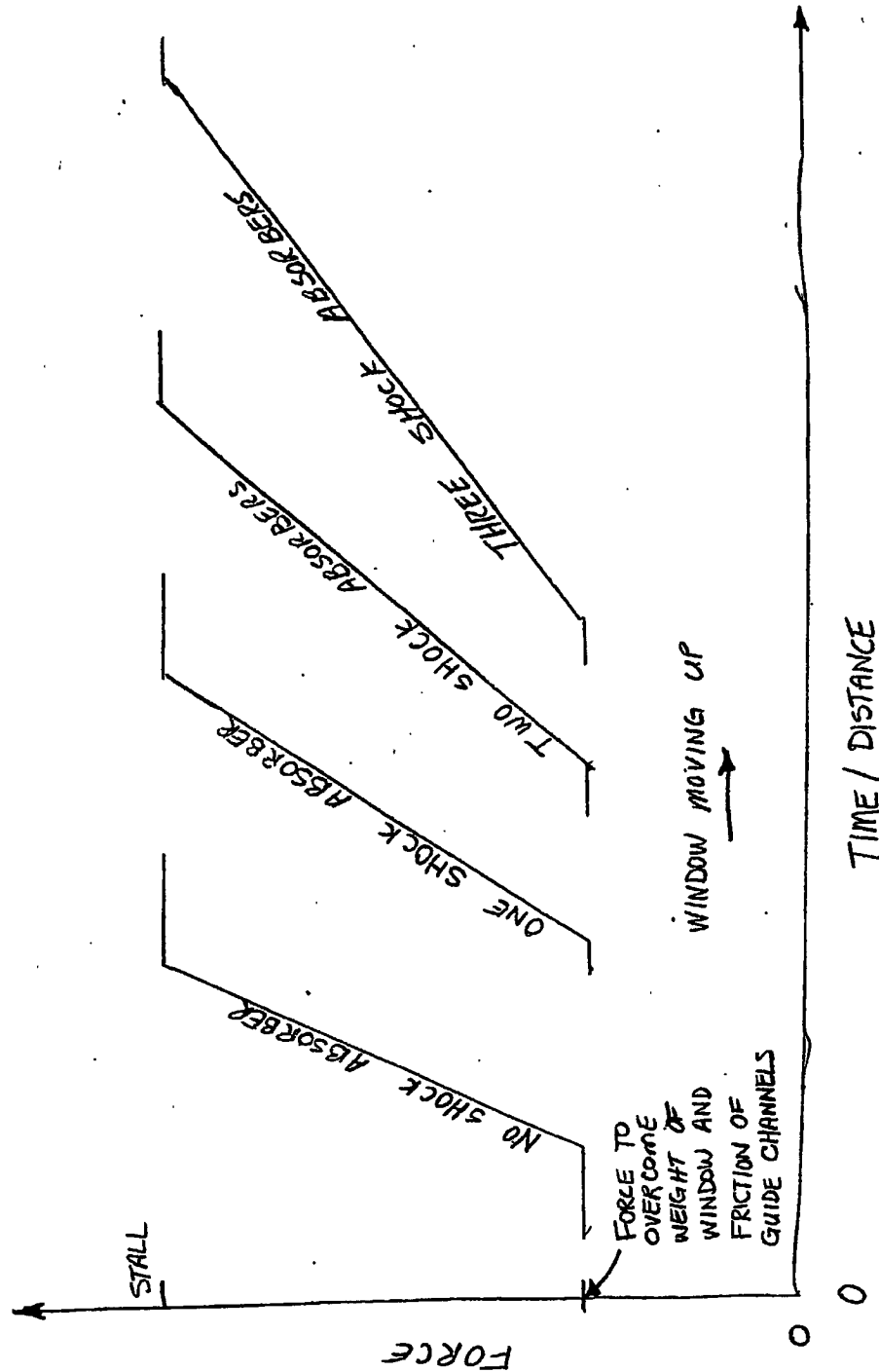
FIG. 11

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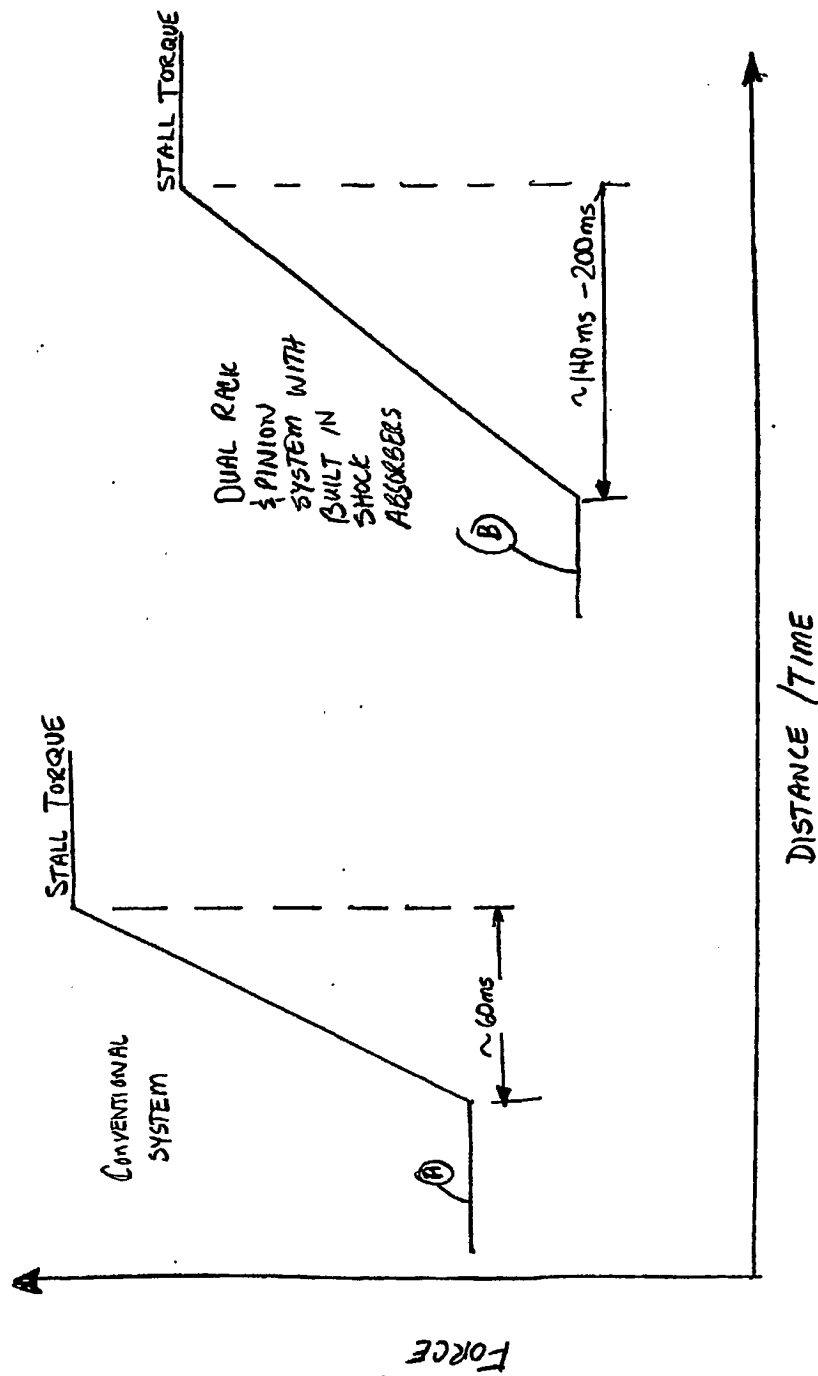
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FIG. 19



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FIG. 20



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